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BIAXIAL CALCITE

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Walker and Parsons[1] have called attention to the anomalous properties shown by some calcites probably formed at high temperatures, and they have ascribed these properties to the molecular rearrangement which would take place at the inversion from alpha calcite at 970°. Among these anomalous properties described by them is a biaxial character, and a value of 15° for 2 E. Moreover the calcite does not exhibit complete extinction, possibly, they thought, due to some molecular disturbance.

In examining some marbles and calcareous schists the writer and several of his students have found examples of calcite, and of dolomite, showing the biaxial character. The marbles in which such grains were found are coarsely crystalline rocks from contact metamorphic zones. The other rocks also show evidence of intense soaking by hot solutions. After some experience it has become a simple manner to select in a thin section those grains in an aggregate which will show the biaxial figure. These grains do not become entirely extinct on rotation of the stage, but rather take on a mottled blue appearance in the extinction position. In working with grains mounted in viscous Canada balsam, such grains when turned into the proper position, give the biaxial figure.

There is no possibility that the grains giving the biaxial figure are grains of aragonite mixed with the calcite. The grains possess the rhombohedral cleavage and twinning of the members of the calcite group, and moreover the size of the optic angle varies among the grains in a single specimen. Furthermore, it is very improbable that aragonite would be found in a pre-Cambrian or early Paleozoic rock.

[1] Walker, T. L. and Parsons, A. L.; The characteristics of primary calcite: *Univ. Toronto Studies, Geol. Ser.*, No. **20**, Contributions to Canadian Mineralogy, 1925, pp. 14–17.

The examples listed below were found in the Technology collection. They will show that this feature is not limited to any geological horizon, nor any geographical location.

Contact metamorphosed limestone from the Shamrock Mine, Garnet, Montana. Specimen collected by W. O. Crosby from near the contact with the granite. Maximum optic angle noted, $2V=13°$.

Grenville limestone,[2] from Cascade Lake, Mount Marcy quadrangle, Essex County, New York. Maximum angle noted, $2V=$about $5°$.

The Number Two Paleozoic limestone,[3] above the orebody, magnetite iron mine of Bethlehem Steel Company, Cornwall, Pa. Maximum angle noted, $2V=5.8°$.

Cambrian limestone,[4] from the vicinity of the abandoned iron mines, north of Manhattan Gap, Highland quadrangle, Lincoln County, Nevada. Maximum angle noted, $2V=11.3°$. An adjacent grain to this one gave a reading of 4.5°.

Dolomite zone in same area as previous sample. Maximum angle noted, $2V=8.7°$. Another grain in the same thin section gave 4.5°.

Cambrian limestone bed in Cambrian shale, near contact with quartz monzonite, in the central part of the same quadrangle as last samples. Maximum angle noted, $2V=4.0°$.

Cambrian limestone[5] from east shore of Pend Oreille Lake, south of South Gold Creek, Bonner County, Idaho. Maximum angle noted, $2V=10.0°$.

Grenville limestone,[6] Tilly Foster Iron Mine, Putnam County, New York. Maximum angle noted, $2V=14.0°$. A doubtful reading of 20° was made.

Quartz-biotite-epidote-calcite schist[7] from the west dump of No. 3 tunnel driven in the building of the Weston, Mass., aqueduct. Maximum angle noted about 5°.

Calcite in Iron Ore of the Andover Iron Mine, Andover, N. J.[8] Maximum angle noted about 5°.

[2] Described by Lary, H. N.; Some phases of contact metamorphism in the southeastern Adirondacks. (Thesis presented to the faculty of the Mass. Inst. Technology in partial fulfillment of the requirements of the degree of Master of Science, 1927.)

[3] Described by Callahan, W. H.; The magnetite deposit at Cornwall, Pa. (Thesis presented to the faculty of the Mass. Inst. Technology in partial fulfillment of the requirements of the degree of Master of Science, 1927.)

[4] Gillson, J. L.; Contact metamorphism near Pioche, Nevada. In preparation.

[5] Samson, Edward and Gillson, J. L.; The geology and ore deposits of the Pend Oreille Mining District of northern Idaho. To be published as a bulletin of the U. S. Geological Survey.

[6] Colony, R. J.; Magnetite iron deposits of southeastern New York. *New York State Mus. Bull.* **249–250**, pp. 121–124 (1923).

[7] Warren, C. H.; Petrographical notes on the rocks of the Weston aqueduct, Mass. *Technology Quarterly*, **17**, pp. 117–123 (1904).

[8] Rexford, E. P.; The mineralization of the Andover and Sulphur Hill Mines near Andover, N. J. (Thesis presented to the faculty of the Mass. Inst. Technology in partial fulfillment of the requirements of the degree of Master of Science, 1927.)

Calcite replacement in quartzite of the Coos group, near Chandler Mills, N. H. The rock there was apparently metamorphosed by the Concord, N. H., granite.

Some of the biaxial figures obtained are so clear and sharp that there can be absolutely no doubt of the anomalous optical character of the grains. Moreover, all such grains show the incomplete extinction mentioned by Walker and Parsons.

A discussion of the probable transition from beta calcite (the low temperature modification) to the higher alpha form is given by Grubenmann and Niggli.[9] The quadruple point is only established thermally, but is given by them as 970° and 40 atmospheres pressure. From the quadruple point the boundary curve between the two solid modifications rises nearly perpendicularly, since in a condensed system the pressure has but little influence. These authors further state that the transition from the alpha to the beta form is unrecognizable in the end products, although they imply the importance of such recognition were it possible. This importance has been stressed by Walker and Parsons, and in fact it can not be overestimated. If by the recognition of optical anomalies in a contact limestone, a temperature as high as 970° can be established, the intrusive temperature of the igneous body must have been well above 1,000°. Grubenmann and Niggli[10] state that even near the contact a difference in temperature between wall rock and intrusive of 300° is probable in many cases.

Smyth and Adams[11] have lately shown, however, that no high temperature modification of calcite exists. Thus the anomalous properties of calcite can not be connected with the supposed inversion at 970°. From this proof there is no need for alarm that an intrusive temperature as high as 1,000° or higher is indicated by all contact metamorphosed limestones showing biaxial calcite.

If the anomalous properties are not due to an inversion, to what are they do? Some experiments recently undertaken in this laboratory would indicate that the anomalously biaxial character of the rhombohedral carbonates above described may be due to deformation disturbances. Mr. M. J. Buerger of this laboratory has been experimentally able to produce biaxial calcite by sec-

[9] Grubenmann, U. and Niggli, P.; Die Gesteinsmetamorphose, Bd. I, pp. 121–122, *Berlin* (1924).

[10] *Idem*, p. 251.

[11] Smyth, F. H., and Adams, L. H.; The system, calcium oxide-carbon dioxide. *Jour. Am. Chem. Soc.*, **XLV**, pp. 1182–1184 (1923).

ondary twinning on $(01\bar{1}2)$. Microscopically homogeneous fragments of the twins mounted in viscous Canada balsam gave the optical anomalies similar to those observed on the natural material. The artificially twinned portion of one specimen of calcite gave a value for 2V of about 30°. A twin produced from another piece of calcite gave 2V of about 5°, with an extreme dispersion $\rho > \nu$. The dispersion was so strong that three sets of isogyres were observed; orange, red and blue, from the acute bisectrix outward. In all cases the fragments showed incomplete extinction with anomalous colors near the extinction positions.

A more complete discussion of the experimental work will be published by Mr. Buerger in the near future.

A biaxial character in quartz as a result of strain caused by differential stresses has been described[12] as have other deformation structures in quartz.[13]

Although a biaxial character was found on artificially twinned calcite grains, many naturally twinned grains do not show it. A section of the Grenville limestone from a locality on the east shore of the Hudson River near the south end of the North Creek quadrangle in the Adirondacks contains calcite so mashed that its gliding planes are curved. The grains are not biaxial. The grains from the contact metamorphosed limestones that do show a biaxial character usually exhibit little or no other visible evidence of strain.

It is hoped that further experimentation will fully explain the cause of the biaxial character of the members of the calcite group.

STELLERITE FROM NEAR JUNEAU, ALASKA

E. P. Wheeler, 2nd, *Cornell University*.

In the spring of 1925 while at Juneau, Alaska, the writer collected in the upper part of the Granite Creek basin, several miles west of the town, several crystals forming an incrustation on the rock surface. These crystals were later determined as stellerite, and as the literature on this mineral is rather meager the occurrence was considered worthy of description.

[12] Grubenmann, U. and Niggli, P., Der Gesteinsmetamorphose, Bd. I, p. 220 (1924).

[13] Holmquist, P. J.; Deformationsstrukturen der Gesteinsquarze. *Geol. För. Förh.*, Bd. 48, pp. 410–428 (1926).

It occurs in a limonitized zone perhaps fifty yards wide which crosses the Granite Creek basin in a general northwest-southeast direction. This zone may be traced for several miles and is visible from points a mile or so down the valley. On examination of the geologic map of the region,[1] which was not available for some time after the mineral was obtained, the locality was thought to be in the strip of schist between the two large dike-like masses of Coast Range diorite which cut Granite Creek.

The rock to which the crystals are attached is in agreement with this determination, as it is a rather light colored, fine grained, limonite stained mica schist, not at all like the coarse grained diorite of the region. It contains much disseminated pyrite. A study of some of the powdered rock under the microscope showed the presence of quartz, muscovite, a small amount of orthoclase feldspar, nearly colorless tourmaline crystals, and slender needles of rutile. The largest grains of quartz were 0.12 mm. in diameter. This mineral composition and the structure of the rock indicate that it is a somewhat mineralized schist rather than a locally metamorphosed phase of the Coast Range diorite.

The stellerite occurs in tablets approximately 2.5 mm. long, 2 mm. broad, and 1 mm. thick. They are attached at one end, often forming flattened hemispherical rosettes of radiating individuals. In places the crystals have formed on slickensided surfaces and are also cut by slickensides, so that they apparently formed in an open fault fissure between periods of movement along the fault.

The crystallization of the mineral was studied with a Fuess reflecting goniometer. Though the crystal faces appeared quite good under the hand-lens, they did not yield sharp images so that no very accurate results were secured. The crystals correspond exactly with those described by Morozewicz,[2] even to the relative development and perfection of the forms.

Although the interference figure of the mineral showed it to be biaxial, and therefore not in the tetragonal system, the unit prism angle was very near 90°. All effort to determine whether the angle between Morozewicz's (010) face and the prism was greater than or less than 45° was indecisive, even after a large number of

[1] A. C. Spencer; The Juneau Gold Belt, Alaska. *U. S. G. S. Bull.* **287,** Plate 4, p. 12.

[2] J. Morozewicz; Über Stellerite, ein neues Zeolithmineral. *Bull. Int. de l'Acad. Sc. de Cracovie,* **1909,** part 2, p. 344.

measurements had been made, some of which varied by as much as 4° from 45°. The orientation of Morozewicz will be used, though the Alaskan occurrence, as will be shown, indicates that there may be some doubt as to which of the lateral axes is longer. The forms recognized were $\{010\}$, $\{110\}$, $\{100\}$ and $\{111\}$. The brachypinacoid was best developed, and no faces of the $\{210\}$ prism were observed though Morozewicz mentions their occurrence on crystals collected by him. The angles between the different forms as measured on the goniometer were $(111):(1\bar{1}1)=63°\pm1°$, and $(110):(1\bar{1}0)$ approximately 90°.

The plane angle formed by the edges (111) to $(1\bar{1}1)$ and $(\bar{1}11)$ to $(\bar{1}\bar{1}1)$ was measured under the microscope on crystals resting on the (010) face. This angle was found to be $105°\ 22'\pm7'$, the probable error being computed by Bessel's formulae from 35 readings, which gave residuals agreeing quite well with the curve of probability. This is undoubtedly the most accurate measurement made by the writer.

The ratio $a:c$ was computed from this angle, and found to be $1:0.762\pm.002$. Using the prism and pyramid angles given above the ratio $b:c=1:0.776$ was calculated. From these two ratios it was apparent that a and b as given by Morozewicz must be reversed if the macro-axis is to be greater than the brachy-axis, as required in the rhombic system. Making this change, an axial ratio $a:b:c=0.982:1:0.762$ was obtained. It may be pointed out in connection with this change of orientation that a very slight difference in the value of the pyramid angle will reverse the orientation of the mineral.

Morozewicz gives $(111):(1\bar{1}1)=64°\pm1°$ and $(110):(1\bar{1}0)=89°\pm1°$. He also gives the axial ratio as $a:b:c=0.98:1:0.761$, and says that this ratio was computed from the pyramid and prism angles given. However, using these values an axial ratio $a:b:c=0.98:1:0.806$ was obtained, so that either he made an error in his calculations or used data not given in his paper. Thus the exact significance of his axial ratio is not clear.

The mineral was easily scratched with a knife. One excellent cleavage was observed under the microscope parallel to the brachypinacoid, and traces of two others corresponding to the (100) and (001) cleavages of Morozewicz could be seen, giving the mineral a tendency to break up into cubes on crushing.

Its specific gravity was determined by suspension of a number of crystals in a mixture of bromoform and alcohol. These crystals showed more or less surface staining with limonite so that it was to be expected that they would have a specific gravity slightly higher than the pure mineral. The purest crystals floated in a mixture with a specific gravity of 2.141 as determined by means of a Westphal balance, but sank in one with a specific gravity of 2.134, giving a value only slightly above 2.124 as determined by Morozewicz.

When heated before the blowpipe the mineral fused readily with intumescence to a white enamel; a flame test showing the absence of sodium. On treatment with hydrochloric acid it was decomposed with the separation of flocculent silica, but did not yield gelatinous silica on evaporation of the solution, which reacted for calcium with ammonium oxalate. Water was given off upon heating in the closed tube. These reactions are in agreement with the chemical tests of stellerite, the formula of which is $CaAl_2Si_7O_{18} \cdot 7H_2O$.

The mineral showed parallel extinction in all fragments examined under the microscope. The elongation of the crystals was negative, and in a fragment which in converging polarized light showed the emergence of both optic axes, it was found that the mineral was biaxial and negative, with 2V equal to 38° as determined by the Mallard method for sections showing the emergence of both optic axes. Morozewicz's value is 43.5°. The negative character of the mineral coupled with the negative elongation of the crystals showed that crystallographic *c* was the acute bisectrix. When grains rest on the (010) face the form and symmetry of the interference figure and the birefringence, which was then at a maximum, indicated that Y was perpendicular to this face, so that the axial plane was parallel to it.

The indices of refraction were found by the immersion method to be $\alpha = 1.486 \pm .004$, $\gamma = 1.500 \pm .002$, giving a value of 0.014 for $\gamma - \alpha$.

The birefringence was more accurately determined by measuring the thickness of crystals placed on edge under the microscope with a micrometer ocular, and determining the order of the interference color of the crystals when resting on the (010) face. An average of 5 determinations on different crystals gave a value of 0.0115 for $\gamma - \alpha$, the maximum and minimum values obtained being 0.0130 and 0.0105.

To make the determinations of indices agree with this determination of birefringence $\alpha = 1.488$ and $\gamma = 1.499$, the distribution of error being based on the relative closeness of the index of the mineral to that of the liquids above and below the index. These values are distinctly higher than those given by Morozewicz, namely $\alpha = 1.484$, and $\gamma = 1.495$.

Thus the physical, chemical, and optical properties, as well as the crystallization of the mineral agree so closely with those determined for stellerite that there can be no doubt as to the identity of the mineral.

The occurrence of stellerite in two localities having such similar and unusual climatic conditions as the Komandorski Islands and the southeast coast of Alaska, where precipitation is very high and the average temperature comparatively low, and its absence so far as known in other localities suggests that these factors may have some influence on the stability of this zeolite. The coating of the zeolite in both localities with limonite, which would seem to have formed while the mineral was in the zone of weathering makes it probable that the stellerite formed at a great enough depth to be beyond the influence of climatic conditions. Therefore, if they are connected with the occurrence of stellerite it is more likely to be by preventing its alteration to other minerals than as a cause of its formation. This is also suggested by the occurrence of a reticulation of minute cracks on the surface of the crystal apparently due to corrosion, as though the mineral were not altogether stable under the existing surface conditions. The marked effect of temperature on the water content of stellerite pointed out by Morozewicz lends weight to this suggestion. In warmer, drier climates the water content might be reduced, stability being restored in time by a change to some other mineral.

A NEW ANALYSIS OF THE MABERLY, ONTARIO, EUXENITE

H. V. Ellsworth[1].

One of the older known occurrences of euxenite in Ontario is that on lot 13, con. V, South Sherbrooke township, Lanark County, near the village of Maberly. This was first described by Willet G. Miller and Cyril W. Knight[2] with an analysis by the Imperial Institute, London. This analysis gave only a very small Pb/U+0.38 Th ratio and consequently indicated a very late age, perhaps Carboniferous for the pegmantite in which it occurs, a conclusion not in accord with the geological evidence as the dike appears to be no different in any way from many other middle Precambrian pegmantites of Ontario now known to be between 1100 and 1200 million years old. It should be noted, however, that Miller and Knight considered that there is evidence for the existence of a younger Precambrian granite[3] in the ancient complex of central Ontario. The samples analyzed by the Imperial Institute came from the first superficial workings and quite likely were considerably leached and altered. As the writer subsequently obtained large quantities of very fine apparently fresh material from a depth of 30 to 40 feet, it was thought to be worth while to analyze a large average sample with a view to check the age of the pegmatite.

The sample for analysis consisted of 200 grams of the finest, pure, brilliant fragments picked at random from an average sample of the coarse concentrate[4]—in all 14 lbs.—derived from 1593 lbs. of euxenite-bearing feldspar which was tabled by the Ore Testing Division. The 200 grams selected represented an average sample of the total euxenite concentrate of 58.12 lbs. obtained from 1593 lbs. of ore. It appeared that there might be some variation in different euxenite individuals, as some grains were darker in color than others and possibly would be found to carry more iron or uranium, or both, if they were to be analyzed separately, but no detailed study was made of the differently colored specimens, the intention being simply to secure an average sample of the whole concentrate. The 200 gram lot was reduced to 100 mesh, mixed and resampled, a smaller lot being finally ground fine for analysis.

[1] Published by permission of the Director of the Geological Survey of Canada.

[2] *26th Ann. Rept. Ont. Bureau of Mines* (1917).

[3] *Report of the Bureau of Mines, Ont.*, Vol. XXII, Second Part (1914).

[4] *G. S. C. Sum. Rept.* (1921), part D, p. 69D.

Several determinations of Pb, U and Th were made in the course of the investigations on analytical methods, in some instances quantities of 5, 10, and even 20 grams being used, so that the results for these elements are believed to be accurate to two or three hundredths of one per cent. The analysis gave the following results:

Euxenite, Lot 13, Con. V, South Sherbrooke Township, Lanark County, near the Village of Maberly, Ontario

	Per Cent	Mol. Wt.	Bases	Acids
PbO	1.01	222	0.0046	
($Pb=0.94$)				
UO_2	7.25	270.2	0.0268	
UO_3	1.51	286.2	0.0053	
($U=7.56=8.92\ U_3O_8$)				
ThO_2	2.64	264	0.0100	
($Th=2.32\text{x}0.38=0.88$ U equiv.)				
(Ce, La, Di)$_2O_3$	0.87	330	0.0026	
(Yt, Er)$_2O_3$ (Average At. Wt.$=108.1$)	24.95	264	0.0945	
FeO	0.14	72	0.0019	
Fe_2O_3	2.16	159.7	0.0135	
MnO	0.19	70.8	0.0027	
Al_2O_3	0.45	102.2	0.0044	
BeO	0.05	25.1	0.0019	
CaO	2.03	56	0.0362	
MgO	0.07	40.3	0.0019	
ZrO_2 . . . . . Not detected	0.00	122.6		
SnO_2	0.14	150.7		0.0009
TiO_2	25.04	80.1		0.3126
Ta_2O_5	5.32	443		0.0120
Cb_2O_5	22.28	266.2		0.0837
SiO_2	1.08	60.3		0.0179
$H_2O-110°$	0.08			
$H_2O+110°$	2.29			
	99.55		0.2063	0.4271

Sp. Gr.$=4.983$ at 22.94°

Pb/U$+0.38$ Th$=0.11=870$ million years

Although this analysis indicates a much greater age than the earlier one, it is still less than the general average (1100–1200 million years) for the Ontario Precambrian. The writer at one time considered this result as evidence for the later age of some of the Ontario Precambrian but now after more experience with these

complex minerals is inclined to believe that the low age result is simply an indication of a certain amount of leaching or replacement of the lead, possibly by silica. In a number of analyses of euxenites and similar minerals of Ontario only those with no silica, or very little, have indicated ages in accord with those of uraninites. In some instances complex Ti, Ta, Cb minerals occurring in close association with uraninite have yielded ratios which are only a small fraction of the uraninite ratio. Such complex minerals may contain from 1 to 2 per cent of silica. Microscopic examination of thin sections with arc light illumination shows that these minerals are invariably completely shattered, just as are the uraninites, by the internal strains set up by autoxidation, the sections being traversed in every direction by inumerable fractures of varying intensity. Many of these fractures are, even microscopically, very short and minute and apparently entirely internal. Others are much more strongly developed, extend to the exterior of the mass and connect with many smaller tributary fractures, the whole much resembling a river with its tributary streams. Normal alteration, probably involving silication is made evident along the edges of the stronger fractures by a bleaching of the usual reddish brown color. Thus it is easily understood how these minerals can be penetrated and acted on by natural waters containing silica in solution. While there may be no direct connection between the presence of silica and a too low lead content, a silica content seems to indicate quite definitely that a certain type of alteration involving loss of lead has occurred.

The reliability of uraninite as an age indicator is now too well established to be seriously questioned and discrepancies in results from the complex Ti, Ta, Cb minerals seem to be best explained by assuming that some of the lead has been lost by leaching or replacement.

I. URANOTHORITE FROM THE MACDONALD MINE, HYBLA, ONTARIO.

II. ALPHA AND BETA HYBLITE—NEW SULFATIC ALTERATION PRODUCTS OF THE HYBLA THORITE

H. V. Ellsworth[1].

I. Among some specimens collected from the dump of the MacDonald Feldspar Mine[2] was one which proved to be uranothorite, a new mineral for this mine and in fact the first known occurrence of thorite in Canada.

The specimen consists of aggregates of black crystals set in a mixture of quartz and somewhat decomposed and rusty feldspar. Both quartz and feldspar surrounding thorite are severely fractured, the fractures radiating generally in a direction normal to crystal surfaces. The crystals are typically elongated square prisms varying from one-eighth to one-half inch in cross section, and terminated in many cases by the basal pinnacoid. They are very brittle and cannot be extracted intact from the rock. Most of the thorite crystals in contact with feldspar are superficially altered for a depth of one quarter millimetre or less to a soft, pearly white mineral of about the color and lustre of porcelain. Where thorite is in contact with quartz there is generally little or no alteration product, and the thorite is black and fresh right up to the contact. In some cases part of a single thorite crystal is altered where in contact with feldspar, fresh where enclosed by quartz. On close inspection under the binocular microscope patches of a paper-thin coating of more or less altered pyrite may be seen lining the feldspar in cavities from which thorite crystals have been broken out and also in fractures in the feldspar, while there is little or no pyrite at quartz-thorite contacts. Occasional minute grains of pyrite also occur embedded in the thorite crystals themselves. These have not oxidized. It seems very probable that originally there was a film of pyrite enveloping nearly all the thorite surfaces in contact with feldspar and that the thin layer of thorite alteration products is due to the action of sulphuric acid resulting from the oxidation of the pyrite. (Fig. 1.) Where the alteration has been most intense there is a second alteration

[1] Published by permission of the Director of the Geological Survey of Canada.

[2] *G. S. C. Summary Report* (1923), Part CI.

product, between the feldspar and the white material. This also occurs only in extremely thin films and minute patches, never over one quarter millimetre thick, and where a crystal has broken out this mineral usually remains attached to the feldspar, whereas the white mineral is more likely to remain attached to the thorite. This alteration product is transparent to translucent, of a yellowish color and resinous lustre, resembling some varieties of allophane in appearance.

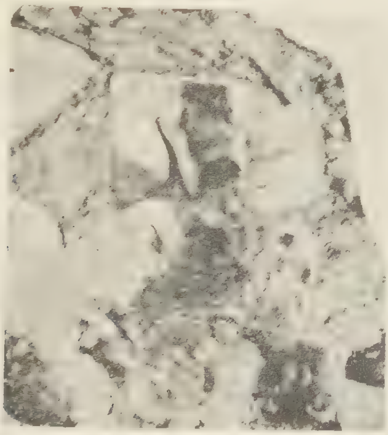

Fig. 1.
Crystal of uranothorite (X 3) showing thin white line of alteration products next to matrix.

That many of the thorite crystals are quite perfectly formed is indicated by various sections exposed where the feldspar with its contained crystals has broken in suitable directions. Nearly all the crystals, however, appear to connect with others at some point, so that the whole might almost be described as a "graphic intergrowth" of thorite with feldspar and quartz.

The thorite is black en masse, in thin sections brownish and isotropic; powder brownish grey. Lustre sub-vitreous to pitchy. Cleavage not apparent, fracture subconchoidal, very brittle. Hardness 4.5 to 5. Sp. Gr. = 4.414. $n = 1.710$.

An analysis of carefully selected crystal fragments free from alteration products yielded the following results:

Uranothorite, MacDonald Mine, Hybla, Ontario

	Per Cent.	Mol. Wt.	Bases	Acids
PbO	1.32	222	0.0059	
(Pb = 1.22)				
*UO_2	7.67	270.2	0.0284	
UO_3	9.46	286.2	0.0330	
(U = 14.63 = 17.25 U_3O_8				
ThO_2	46.33	264	0.1755	
(Th = 40.72x0.38 = 15.47 U equiv.)				
(Ce, La, Di)$_2$O$_3$	0.08	330	0.0002	
(Yt, Er)$_2$O$_3$	0.36	250	0.0014	
FeO	0.43	72	0.0060	
Fe_2O_3	0.75	159.7	0.0047	
FeS_2	Traces present			
MnO	0.07	70.9	0.0010	
Al_2O_3 } BeO	0.13	102.2	0.0013	
		25.1		
CaO	4.38	56	0.0782	
MgO	<0.01	40.3		
SiO_2	19.56	60.3		0.3244
			0.3356	0.3244
$H_2O-110°$	3.57			
$H_2O+110°$	5.67	18	0.3150	
Insol.	0.15			
He	Not determined.			
	99.94			

Sp. Gr. = 4.414 at 22.70°
$n = 1.710$
Pb / U + 0.38 Th = 0.04

* It was impossible to get consistent results for UO_2 on the main sample due to the presence of traces of pyrite. The value given was obtained on a separate specially selected small sample.

The mineral is evidently a high uranium, high calcium thorite, with apparently a greater content of both U and Ca than any previously known.

In view of the very evident alteration of this mineral it is not surprising that the lead should be low and the apparent age only a small fraction of that indicated by the Ontario uraninites. The Pb/U+0.38 Th ratio is about the same as that determined by Todd[3] for ellsworthite from the same mine. Nevertheless, it is

[3] Walker and Parsons, *University of Toronto Studies*, (1923).

rather remarkable that the two minerals—i.e., thorite and ellsworthite—so different in composition, should even agree as well as they do, granted that both have been greatly altered and leached. There is no geological evidence, however (in the writer's opinion), to indicate that the MacDonald dike is younger than other dikes of the Ontario Precambrian known to be 1100–1200 millions of years old. For instance, uraninite from a somewhat similar calcite-bearing pegmatite on lot 4 con. XXI Cardiff township, Haliburton county, Ontario (the Richardson property), about twenty miles distant yields the normal ratio 0.15. Geologically, the occurrence of considerable quantities of calcite and dark purple fluorite in both dikes as well as in many other pegmatites of the Bancroft area, seems to indicate a close relationship of all of them to one period of intrusion, so that in spite of the low age indications of the ellsworthite and thorite, the writer believes that the MacDonald dike cannot be younger than the Richardson pegmatite just mentioned.

II. The two minerals resulting from sulphatic alteration of the thorite as mentioned in Part I occur in such minute amounts that it was impossible to isolate sufficient quantities for quantitative analysis. Careful qualitative microchemical tests indicated that thorium is the most prominent constituent of both, with uranium apparently next in importance. Iron and small amounts of lead are present, with SO_3 and SiO_2 as acids. Carbon dioxide was not detected. As only the most minute quantities could be obtained in approximately pure condition it was impossible to do more than identify the main constituents. Thorium was positively identified in both cases by the formation of the oxalate with oxalic acid in hydrochloric acid solution and by the formation of the peroxynitrate precipitate in a neutral nitrate solution. Relatively large Th precipitates were obtained.

Both minerals appear to be hydrous basic sulfo-silicates of thorium chiefly, with minor uranium, iron and lead and quite likely some aluminium and calcium. There does not appear to be an abnormal amount of lead present—i.e., no more than would roughly correspond to the amount present in the thorite itself. These alteration products were examined in the first instance with the idea that they might represent a concentration of lead compounds derived from the thorite, but no evidence was obtained which would indicate the presence of lead in increased amounts.

The sulfate reactions obtained may of course be due solely to lead sulfate though there appeared to be more SO_3 than would correspond to the lead present. The yellow-brown alteration product in particular might be expected to contain aluminium derived from the feldspar, which also appears to have been considerably attacked by the decomposing pyrite.

The white mineral will be referred to here as alpha-hyblite, the yellow-brown one as beta-hyblite.

Although alpha-hyblite appears opaque, pearly white or porcelainic under the binocular, minute grains when immersed in oils under fairly high power are brownish, transparent to cloudy, isotropic and without visible definite cleavage, though it may have a scaly cleavage or parting. With high power many extremely minute bubbles are visible which perhaps are aggregations of entrapped helium. These bubbles probably contribute largely toward producing the brownish color at lower magnifications, but even with high powers the mineral itself still appears yellowish. The great majority of grains selected at random from different crystals have indices between 1.540 and 1.545 which seems to indicate that most of the material is one fairly definite compound. A few grains which go as high as 1.580 are perhaps transitional to beta-hyblite.

Beta-hyblite under the binocular appears yellowish brown with resinous lustre and conchoidal fracture and is transparent to translucent. It is very brittle and easily scratched by a needle point but is harder than alpha-hyblite. In oils under the microscope it is yellowish to brownish, isotropic and definitely granular whereas alpha-hyblite is powdery or scaly. The beta-hyblite is without bubbles and it also shows no cleavage. The great majority of the grains taken at random have indices between 1.605 and 1.610 not exceeding the latter value.

As the most completely altered yellow thorites listed by Larsen do not go below $n=1.68$ it is evident that these two materials are very different in every way from the usual alteration product of thorite.

McGOVERNITE, A NEW MINERAL FROM STERLING HILL, NEW JERSEY

C. Palache and L. H. Bauer.

A mineral was found in the zinc mine at Sterling Hill in January, 1927, which cannot properly be classified with any species hitherto known. It was found in the North Drift, 900 foot level of the mine, and appears to have constituted the principal filling of a vein in massive ore.

The material is a rather uniformly granular mass of coarse grain, the individual grains showing a very perfect, almost micaceous cleavage. This cleavage and the deep red brown color of the cleavage plates in transmitted light, together with the reddish, somewhat bronzy color of the mass in reflected light, give to the mineral a very different appearance from that of any other of the related substances found there or at Franklin.

It proved on optical examination to be uniaxial, the cleavage being basal like that of friedelite; it is therefore probably hexagonal in crystallization. It is optically positive with $\omega = 1.754$. The specific gravity is 3.719.

Material for analysis was purified in the Harvard Mineralogical laboratory and the analysis was made in the laboratory of the New Jersey Zinc Co. under the direction of the junior author, with the following result:

	Per cent	Molecular Ratios	
SiO_2	8.92	.148	$= 3\times.049$
MnO	42.72	.603	
FeO	1.53	.021	$1.029 = 21\times.049$
MgO	11.27	.280	
ZnO	10.22	.125	
As_2O_3	4.45	.023	$= \frac{1}{2}\times.046$
As_2O_5	12.48	.054	$= 1\times.054$
H_2O	8.49	.472	$=10\times.047$
	100.08		

These figures lead to no simple and satisfactory formula, the simplest expression representing the results of the analysis being: $21(Mn,Mg,Zn)O \cdot 3SiO_2 \cdot \frac{1}{2}As_2O_3 \cdot As_2O_5 \cdot 10H_2O$.

The presence of arsenic in this mineral in two states of oxidation was established by the following procedure. The powder is treated with $ZnCl_2$ and conc. HCl to repeated distillation at a temperature

not exceeding 115°C. All As_2O_3 is thus transferred to the condensing flask where it is determined by titration. The residue in the flask is reduced with filter paper, CuCl, and more conc. HCl, any As_2O_5 present thus being changed to As_2O_3, which is then determined by a repetition of the first process.

The mineral most nearly resembling this one in appearance and physical properties is dixenite, described by Flink from Långban, Sweden. To it has been assigned the almost equally complex formula: $21(Mn,Ca,Fe)O \cdot 4SiO_2 \cdot 4As_2O_3 \cdot 5H_2O$.

No attempt will here be made to transform either of these empirical formulae into a more intelligible form. Material is accumulating from the study of Franklin and Sterling Hill occurrences tending to show that these two minerals are part of a group together with friedelite, schallerite and some intermediate members. A full discussion of this relationship is reserved for a future paper when the material has been more fully elaborated.

The authors take much pleasure in naming this new mineral for J. J. McGovern, for many years the foremost of local collectors at Franklin, who died in 1915. From his place of duty at the picking-table at the shaft-head his keen eyes enabled him to save many a rare specimen from going to the crusher; and as he was always ready to place his discoveries in the hands of scientific mineralogists for study, he added largely to our knowledge of Franklin mineralogy.

OPTICAL NOTES ON SOME OF THE VARIABLE CONTACT MINERALS FROM EDENVILLE, NEW YORK

M. J. Buerger, *Massachusetts Institute of Technology.*

The writer has recently completed a brief study of the optical properties of some of the contact minerals from the limestone near Edenville, New York, and since the constants of several of these variable species differ from those recorded in standard reference books, it seems of interest to record the data obtained. The specimens were collected in August, 1925, by Dr. Joseph L. Gillson. Referring to the U. S. Geological Survey topographic sheet of the Goshen, N. Y., quadrangle, the specimens were taken from a stone fence near the road forks marked 451 (elevation), a little over a mile northwest of Edenville. Actual contact exposures are poor.

The geology of the locality has been described by Kemp and Hollick.[1] Briefly summarized, relatively small masses of granitic rock are intrusive into Cambrian limestone with the attendant development of characteristic contact minerals.

The minerals visible in hand specimens include: a black amphibole with conspicuous cleavage faces; rounded granules and cleavage flakes of golden-brown phlogopite; irregular areas of greenish-tinged scapolite; dolomite; quartz; serpentine; tourmaline; perthite; minute amounts of pyroxene; and the metallic minerals: graphite, pyrite, arsenopyrite, and pyrrhotite. Microscopic examination further reveals the presence of rounded grains of pleochroic titanite and shreds of muscovite, the latter as an alteration product of the scapolite. Heinrich Ries, in an appendix to Kemp and Hollick's paper,[2] lists a great number of other minerals found in this locality.

Scapolite.—The scapolite examined checked with the data listed by Larsen[3] for wernerite, having indices:

$$e = 1.552 \pm .003$$
$$\omega = 1.581 \pm .003.$$

These correspond with the indices of mizzonite (marialite 60, meionite 40) on Winchell's graph.[4] However, fragments from portions of some hand specimens gave anomalous biaxial figures with small optic axial angles.

Phlogopite.—Phlogopite is apparently of general occurrence in the area, being found both at the contact and in the crystalline limestone at some distance from the intrusives. The hand specimens show it to occur as numerous, well-rounded, dark granules with bronzy to golden-brown cleavage faces. The optical properties were determined as:

Biaxial negative			Pleochroism
$\alpha = 1.546 \pm .003$	$2V = 14°$	Optical orientation	X = Colorless
$\beta = 1.580 \pm .003$		X = c, Approximately	Y = Yellowish pink
$\gamma = 1.580 \pm .003$	$\rho < \nu$ Strong		Z = Yellow with brownish tinge

Absorption X < Y and Z

[1] Kemp, J. F. and Hollick, Arthur; The granite at Mounts Adam and Eve, Warwick, Orange Co., N. Y., and its contact phenomena. *Ann. N. Y. Acad. Sci.*, **7**, pp. 638–654 (1893).

[2] *Op. cit.*, pp. 651–654.

[3] Larsen, Esper S.; The microscopic determination of non-opaque minerals. *Bull.* **679**, *U. S. Geol. Survey*, p. 195 (1921).

[4] Winchell, A. N.; The properties of scapolite. *Am. Mineral.* **9**, fig. 1, p. 110 (1924).

Kemp and Hollick[5] give the optic axial angle of the phlogopite they examined as approximately 5°.

These data do not check with those given by Larsen[6] for phlogopite, the indices being much too low, the dispersion too strong, and the pleochroism different. The indices check much better with Larsen's cryophyllite[7] but the absorption is different, especially for the direction X. In the absence of an analysis, the mica can not be readily assigned to a definite variety, but its physical appearance suggests it to be a phlogopite.

SERPENTINE.—What appeared, in the hand specimen, to be chondrodite proved, on microscopic examination, to be a biaxial positive serpentine of very low birefringence and small optic axial angle. The β index was determined as about 1.545. The serpentine is doubtless the alteration product of chondrodite, for practically the same condition is mentioned by Kemp and Hollick,[8] who wrote, "The alteration [of chondrodite] yields an isotropic aggregate . . . . and the whole effect is very like altered olivine."

PYROXENE.—The pyroxene is a light greenish mineral, apparently the same as that mentioned by Kemp and Hollick. Little was done on its optical properties due to the scarcity of material; only one or two small grains were available. The data on hand are:

	Biaxial positive.	
$\alpha = 1.685$[9]	2V = rather small	Pleochroism not noticeable
$\beta = 1.690 \pm .003$	$\rho > \nu$ moderate	
$\gamma = 1.705 \pm .005$		

AMPHIBOLES.—The Edenville amphiboles offer a very interesting mineral series. At least three varieties are recognized from this locality: edenite, pargasite, and hornblende (unqualified). In the sui.e studied only pargasite was represented but through the courtesy of Mr. Earl V. Shannon some fragments of type edenite were obtained for the purposes of optical study. The optical properties determined on edenite and pargasite were:

[5] *Op. cit.*, p. 644.
[6] *Op. cit.*, p. 255.
[7] *Op. cit.*, p. 251.
[8] *Op. cit.*, p. 647.
[9] The α index was estimated, but is probably not in error by more than .005.

EDENITE: Biaxial postive.[10]

$\alpha=1.606\pm.003$ $\beta=1.617\pm.003$ $\gamma=1.634\pm.003$	2V = large $\rho>\nu$ distinct	Optical orientation $Y=b$ $Z\wedge c=31°$	Color of hand specimen: white, with greyish tinge

Pleochroism, none.

PARGASITE: Biaxial positive.

$\alpha=1.638\pm.003$ $\beta=1.645\pm.003$ $\gamma=1.654\pm.003$	2V = 80° approx. $\rho>\nu$ quite distinct	Optical orientation $Y=b$ $Z\wedge c=31°$	Color of hand specimen: black, with brownish tinge

Pleochroism: X = pale greyish, almost colorless, Y = pale brownish; Z = pale greyish with a bluish cast

Absorption: $X<Y$ and Z

No hornblende was examined, but the pleochroism of the pargasite is somewhat similar to that mentioned by Kemp and Hollick[11] for a greenish-brown hornblende occurring in the limestone between Mounts Adam and Eve, which had: X = very light yellow; Y = faint yellowish brown; Z = faint bluish green. The extinction angle is given by these authors as 20°.

Ford[12] gives as the optical properties of the Edenville hornblende:

Biaxial Negative

$\alpha=1.6583$ $\beta=1.6701$ $\gamma=1.6789$	$2V=81°42'$ $Z\wedge c=23°48'$	Pleochroism: X and Y = light brownish-green; Z = dark green

Absorption: $Z>Y=X$

Fortunately the analyses of these minerals are available for comparison.

[10] This sign is uncertain, optic axis figures yield practically straight bars. If the sign is (−) the dispersion accordingly is $\rho<\nu$.

[11] *Op. cit.*, p. 645.

[12] Ford, W. E.; A contribution to the optical study of the amphiboles. *Am. Jour. Sci.*, (4) 37 p. 181 (1914).

	I Edenite from Edenville	II Pargasite from Edenville	III Hornblende from Edenville
SiO_2	51.67	42.50	41.99
TiO_2	.....	0.63	1.46
Al_2O_3	5.75	15.65	11.62
Fe_2O_3	2.86	5.65	2.67
FeO	.....	8.54	14.32
MnO	.....	trace	0.25
MgO	23.37	11.66	11.17
CaO	12.42	13.40	11.52
K_2O	0.84	not deter.	0.98
Na_2O	0.75	not deter.	2.49
H_2O total	0.46	1.01	0.69
F_2	.....	not deter.	0.80
	98.12	99.04	99.96

I Analysis No. 100 quoted in Dana's System, 6th Edition, p. 395.
II Analysis by Earl V. Shannon.
III Analysis No. 7 given by W. E. Ford, *Op. cit.*, p. 181.

Analysis II was made on about one-half gram of the pargasite appearing in the hand specimens collected by Dr. Gillson. While the weight of the sample was indeed small, it was very pure, having been hand picked under high power binoculars and found to be free from impurities by microscopic examination. The small amount of the sample sent for analysis precluded the determination of sodium, potassium and fluorine, but the total shows that these are probably not in excess of one per cent.

It will be noted that the usual increase of refractive indices and absorption accompanies an increase in iron content. However, the number of replacing atoms in the crystal series makes any exact linking of optical properties and chemical composition very complicated. The extinction angle is greatest for the intermediate pargasite and it is noteworthy that while hornblende is almost always optically negative, the pargasite examined is positive and the edenite is also positive, but with an optic axial angle of almost, if not quite, 90°.

NOTES AND NEWS

The British Museum of Natural History has purchased a magnificent crystal of beryl (aquamarine) of gem quality. It is 13 cm. high, has a diameter of 10–12 cm. and weighs 2505 grams. The beryl comes from Brazil. This gem is exceptional both for its size and for the perfection of its crystal development.

According to tests recently made by A. Mallock and reported in *Nature*, iridium is the hardest pure metal followed by molybdenum, tungsten and rhodium. Nickel is the hardest of the common metals and ranks fifth.

The Oklahoma State College conferred the honorary degree of doctor of science upon Professor W. A. Tarr, professor of geology at the University of Missouri and a member of the Council of The Mineralogical Society of America.

According to *Science* Dr. Henry S. Washington, of the Geophysical Laboratory of the Carnegie Institution, has been nominated by the Italian government an officer of the Order of the Crown of Italy and has received from the Italian ambassador the cross of the order in recognition of his work on the rocks and volcanoes of Italy.

NEW MINERAL NAMES

Comuccite

C. Doelter: Handbuch der Mineralchemie, 4, first half, pp. 481–482 (1926).

Name: In honor of P. *Comucci* who analyzed the mineral (Atti R. Accad. Lincei, 25, 11, 1926).

Chemical Properties: A sulfantimonide of lead. Analysis: Fe 3.99, Pb 37.86, Sb 36.01, S 21.54. Sum 99.40.

Physical Properties: Lustre-metallic. Sp. Gr. 5.65.

Occurrence: As lamellar fibrous masses from St. Georgio, Sardinia.

W. F. Foshag

Hengleinite (=cobalt-nickel-pyrite)

C. Doelter: Handbuch der Mineralchemie, 4, first half, 643, 644 (1926).

Name: In honor of A. *Henglein*, German mineralogist who described the mineral under the name "Kobaltnickelpyrit" (*Centr. Min.*, p. 131 (1914)).

W. F. F.

Malladrite

Ferruccio Zambonini and Guido Carobbi: Sulla presenza del fluosilicato sodico e di quello di potassio tra i prodotti dell attuale attivita del Vesuvio. (On the presence of the fluosilicate of sodium and of potassium among the products of the acutal activity of Vesuvius). *Rend. Accad. Lincei.*, Ser. 6, IV, 171–175 (1926).

Name: In honor of Prof. A. *Malladra*, Director of the R. Observatorio Vesuviano.

Chemical Properties: A fluosilicate of sodium, Na_2SiF_6. No analysis given but the composition deduced from its similarity to the artificial salt.

Crystallographic Properties: Hexagonal.

Optical Properties: Uniaxial, negative; birefringence weak. *n* less than water, approximately 1.31.

Occurrence: Found as minute hexagonal prisms sometimes terminated by the pyramid, associated with avogadrite and hieratite among the sublimation products of Vesuvius.

W. F. F.

Sursassite

Johann Jakob: Sursassite, ein Mangansilikat aus dem Val d'Err (Graubünden). (Sursassite, a Manganese Mineral from Val d'Err, Graubünden). *Schweiz. Min. Petr. Mitt.*, **6**, 376–380 (1926).

Name: From the Roman name of Oberhalbstein, *Sursass*.

Chemical Properties: A hydrous silicate of aluminum and manganese: $5MnO \cdot 2Al_2O_3 \cdot 5SiO_2 \cdot 3H_2O$. Analysis: SiO_2 34.91, TiO_2 0.07, Al_2O_3 22.50, FeO 1.36, MnO 28.67, MgO 2.80, CaO 3.17, Na_2O 0.43, K_2O 0.15, H_2O (+) 5.79, H_2O (−) none. Sum 99.88. Another analysis by Quervain is given.

Crystallographic Properties: Probably orthorhombic.

Physical and Optical Properties: Color deep reddish brown to copper red. Biaxial, plane of the optic axes across the needles. Index of refraction high, between 1.75 and 1.76. Birefringence low. Pleochroism strong: X and Z = light yellow, Y = reddish brown.

Occurrence: Found as small, dense radiated botryoidal masses in cracks in the radiolarian cherts of the manganese deposits of Val d'Err, Graubünden, Switzerland.

W. F. F.

Tangeite

K. Nenadkewitch and P. Volkov: On a new mineral—tangeite from Tjujmujun. (In Russian). *Compt. Rend. Acad. Sci. U. R. S. S.*, pp. 43–46 (1926). See also Ivan Kurbatoff, *Centr. Min.*, pp. 345–353 (1926).

Name: From the locality, *Tange* Ravine, Tjujmujun. (Also given as tangueite).

Chemical Properties: A hydrous vanadate of copper and calcium, $2CaO \cdot 2CuO \cdot V_2O_5 \cdot H_2O$. Analysis: CaO 22.40, CuO 32.70, V_2O_5 37.65, H_2O 4.47, SiO_2 0.98, Fe_2O_3 1.02, Al_2O_5 0.61, MgO tr. Sum 99.83. Another analysis is also given.

Physical Properties: Color dark olive green.

Occurrence: Found as fine fibrous and radiated botryoidal masses, fibrous spheroidal masses, spongy masses or as a fibrous crust. The tangeite is the crystalline analogue of the amorphous vanadate referred to as "Turkestan volborthite."

W. F. F.

Weissite

Wm. P. Crawford: Weissite, a new mineral. *Am. Jour. Sci.*, ser. 5, **13**, 345–346 (1927).

Name: In honor of Dr. Loui *Weiss*, owner of the Good Hope Mine.

Chemical Properties: A telluride of copper, Cu_5Te_3. Analysis: Cu 45.84, Te 53.97. Sum 99.81. (Av. of 2 analyses).

PHYSICAL PROPERTIES: Color bluish black tarnishing black. Streak black. Luster shiny metallic. H=3. Sp. Gr. 6.

OCCURRENCE: Found at the Good Hope and Mammoth Mines at Vulcan, Gunnison Co., Colorado, in veinlets up to one inch across, associated with native tellurium, petzite, sylvanite, rickardite and pyrite.

W. F. F.

Zincteallite (="Pufahlite")

FRIEDRICH AHFELD: Zinkteallite und alaskaite aus Bolivia. (Zincteallite and alaskaite from Bolivia). *Centr. Min.*, No. 12, 388–390 (**1926**).

NAME: In reference to its chemical composition a *zinc*-bearing *teallite*. (Probably intended to be "zinkhaltige teallite" and hence zinciferous teallite, abstr.).

CHEMICAL COMPOSITION: A zinciferous teallite. Formula: (Pb, Zn) SnS_2, Analysis: (on material admittedly too impure for a specific gravity determination), Pb 27.81, Sn 45.09, O 2.59, Zn 6.41, S 15.33, Fe 1.29, Sb 1.29, Ag_2O .008. Sum 99.628.

DISCUSSION. This is the mineral described by the author in a preliminary paper under the name pufahlite. Found at the Ichocollo Mine, near Pazña, and also at Carguaycollo, 15 km. east of Station Rio Mulato, Bolivia.

W. F. F.

NEW DATA

Chlorophoenicite

ORIGINAL DESCRIPTION: William F. Foshag and R. B. Gage; *Jour. Wash. Acad. Sciences*, 14, 362 (1924).

NEW DATA: William F. Foshag, Harry M. Berman and Robt. B. Gage; *Proc. U. S. National Museum*, **70**, 1–6 (1927).

CRYSTALLOGRAPHIC PROPERTIES: Monoclinic, habit elongated parallel to b. $a:b:c=2.357:1:2.153$. $\beta=105°34'$. Also $p=0.9135$, $q=2.074$, $e=0.2684$, $\mu=74°26'$. Forms c (001), a (100), s (106), r (102), k ($\bar{1}$04), h (203), p (111).

OPTICAL PROPERTIES: $2V=83°\pm 2°$.

W. F. FOSHAG

Trimerite

G. AMINOFF: Zur kristallographie des Trimerits. (The Crystallography of Trimerite), *Geol. För. Förh. Stockholm*, **48**, 19–43 (1926).

CRYSTALLOGRAPHY: Monoclinic: $a:b:c=2.0834:1:2.1130$. $\beta=59°51'$. The pseudohexagonal form is due to heteroaxial twinning produced by a rotation of 60° about the monoclinic axis of symmetry whereby (100) and (001) come together and (010) falls in the hexagonal basal plane. $a=7.60$Å, $b=16.11$Å, $c=3\times 9.30$Å.

W. F. F.

Buttgenbachite

H. BUTTGENBACH: Cristaux de connellite-buttgenbach. *Ann. Soc. Geol. Belg.*, **50**, pp. 3–8 (1926).

CRYSTALLOGRAPHIC PROPERTIES: Hexagonal, prismatic. $c=1.122$ (From measurements made under the microscope).

W. F. F.

Hydrocerussite

G. Aminoff: *Geol. För. Förh. Stockholm*, **48**, 44–46 (1926). (Extract from notes left by Hj. Sjögren.)

Crystallography: Hexagonal. $(10\bar{1}1):(10\bar{1}\bar{1})=56°10'$, $(0001):(10\bar{1}1)=60°34'-61°2'$, $(10\bar{1}\bar{1}):(000\bar{1})=61°25'-62°40'$, $(10\bar{1}1):(10\bar{1}0)=28°7'$. $c=1.623$.

W. F. F.

Selensulfur

Emanuele Quercigh: *Rend. Accad. sci. fis. mat. Napoli*, **31**, 65–9 (1925).

The examination of some "selensulfurs" by Glenn V. Brown (*Am. Mineral.*, **2**, 116, 1917) showed them to be essentially sulphur without selenium. Quercigh, however, has determined the index of refraction of a number of samples of vitreous brownish amorphous crusts with $n=2.544$ to 2.675, corresponding to a Se content of 83–90.5%.

W. F. F.

Tyuymunite

V. V. Dolivo-Dobrovalsky: *Mem. Soc. Russ. Min.*, 2d ser., **54**, p. 376 (1925).

Crystallography: Orthorhombic with forms: (001); (010); (111).

Optical Properties: $X=c$, $Y=b$, $Z=a$, $2V=48°$. n is about 2. Birefringence $=0.154$.

W. F. F.

Ramsayite

E. E. Kostylena: Ramsayite from Khibinsky and Lovozersky tundras. *Bull. Acad. Sci. Russ.*, ser. 6, **19**, pp. 363–382 (1925).

Crystallographic Properties: Axial ratios ($\frac{1}{2}$ a), $a:b:c=0.6052:1:1.6498$. Forms to new ratios: (100), (410), (210), (320), (110), (011), (111), (211), (311), (411), $(1\bar{2}1)$, (221), (421), (131). Also a new analysis.

W. F. F.